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MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003

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Chapter 7

Operational Merging of MODIS and seaWiFS Ocean Color Products at Level-3

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7.1 INTRODUCTION

One of the primary goals of the SIMBIOS Project was to develop and evaluate methods for the merging of data products from multiple ocean color missions. This merging can be done at the level of observed radiances, water-leaving radiances, or derived products such as chlorophyll. Various techniques have been developed and evaluated, and several are discussed in other chapters of this document. This chapter discusses what is perhaps the simplest form of merger to implement, which is the averaging of Level-3 products from multiple sensors into geo-located, equal area bins. As a demonstration of this technique, software and procedures were developed within the SIMBIOS Project to generate merged Level-3 products from SeaWiFS and MODIS. In coordination with MODIS/Terra oceans collection #4 reprocessing, the SIMBIOS Project began to receive daily Level-3 binned chlorophyll products, and to merge the MODIS products with SeaWiFS Level-3 chlorophyll products within the framework of the SeaWiFS Data Processing System (SDPS). When the first daily binned chlorophyll products from MODIS/Aqua became available, these were immediately incorporated into the merging process as well.

7.2 IMPLEMENTATION

The SeaWiFS products used in the merging are standard 9-km resolution bin files composited over one-day periods. The MODIS products are standard Level-3 daily binned files at 4.6-km resolution. The specific ocean color parameters used are the chlor_a product of SeaWiFS, which is the chlorophyll concentration derived using the OC4V4 algorithm (O'Reilly, 2000), and the chlor_a_2 product of MODIS (Terra & Aqua), which is the chlorophyll concentration derived with the OC3M algorithm (O'Reilly, 2000). The MODIS product suite includes multiple chlorophyll products, but the chlor_a_2 product is considered to be the SeaWiFS-analog.

Both the MODIS and SeaWiFS bin file formats use a sinusoidal distribution of equal area bin elements; however, the MODIS products are generated at a higher resolution than SeaWiFS. The first step in the merging process is to convert the MODIS products to the 9-km resolution of SeaWiFS, to achieve a 1-to-1 mapping of the MODIS and SeaWiFS bins. The SIMBIOS Project developed two pieces of software to accomplish this task. The first, modbin2seabin, converts the MODIS format to a SeaWiFS-like format at the original MODIS bin resolution. This is just a slight reorganization of the Hierarchial Data Format (HDF) fields. The second program, reduce_bin_resolution, is essentially a modified version of the SeaWiFS time binning code which performs spatial compositing of the input bins. For the MODIS files, reduce_bin_resolution effectively averages four 4.6-km bins into a single 9-km bin. The averaging is weighted by the square root of the number of observations within each 4.6-km bin, which is the same approach used for standard temporal compositing of MODIS and SeaWiFS (Campbell et al., 1995).

Once the MODIS products have been converted to SeaWiFS-like format and resolution, the standard SeaWiFS temporal binning code, timebin, is employed to composite the files from both missions into daily, weekly, and monthly Level-3 bin products at 9-km resolution. Again, the time binner performs a weighted average, with weights computed as the square root of the number of observations within each input bin. These binned products are then mapped using the standard SeaWiFS mapping software, smigen, and the mapped files and browse images are distributed through the SeaWiFS Standard Mapped Image browser.